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    <TD WIDTH="15%" NOWRAP VALIGN="top">(72)Inventor : </TD><TD WIDTH="45%"  
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<TR><TD>(54)<B> LIQUID CRYSTAL DISPLAY DEVICE<BR></B></TD></TR>  
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(57)Abstract:<BR>

PURPOSE: To evade the flicker and deterioration of an image by displaying image signals to which different kinds of interpolation processing by a motion adaptive interpolation circuit are applied by picture elements on the boundary part of a moving image part and a still picture part. <BR>CONSTITUTION: The picture element located at the boundary part of the moving image part and the still picture part on a display screen is detected by a boundary judging circuit 8, and it is detected whether or not the motion of the image by the picture element occurs by a judging circuit 7, and the interpolation processing is applied to a scanning line. When the picture element exists at the boundary part, data before one field of the data (image signal) of the picture element is interpolated to an interpolating part for the picture element in a television signal processing circuit 1 in spite of the motion of the image by the picture element.<BR><BR>

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<BR><BR><HR>CLAIMS  
<HR>[Claim(s)]

<BR>[Claim 1]

The digital disposal circuit which receives a compound colour television signal and performs interpolation processing of the scanning line,  
It is the liquid crystal display equipped with the liquid crystal display monitor which performs image display based on the output of this digital disposal circuit.  
This digital disposal circuit

The 1st field memory which carries out 1 field period delay of this compound colour television signal,

The 2nd field memory which carries out 1 field period delay of the output of this 1st field memory,

The motion detector which takes the difference of the input of this 1st field memory, and the output of the 2nd field memory, moves about the picture signal of each pixel from the difference signal, and carries out sequential detection of the information,

The judgment circuit where the appearance force of this motion detector is received, and the picture signal corresponding to this appearance force moves, respectively, there is, and it judges the thing of the animation part of a display image, or the thing of that still picture part as having no motion,  
undergo the output of this judgment circuit and the judgment result about the appearance force of this motion detector, the output before one line, and the output after one line is compared.

The boundary judging circuit which the picture signal over this appearance force judges as whether it is the thing of a pixel located in the boundary section of this animation part and a still picture part, and having those with a boundary, and no boundary respectively,

when the output of this boundary judging circuit and the output of a judgment circuit were undergone, and have none of a case with this boundary, and these boundaries and it is judged with having no motion by this judgment circuit

The picture signal in front of 1 field period of the picture signal over this appearance force is chosen as a television signal of the interpolation scanning line.

It is the liquid crystal display equipped with the television signal selection circuitry which chooses the picture signal in front of one line of the picture signal over this appearance force as a television signal of this interpolation scanning line when you have none of these boundaries and it is judged with those with a motion by this judgment circuit.

<BR><BR>  
<BR><BR><HR>DETAILED DESCRIPTION  
<HR>[Detailed Description of the Invention]

<BR>[0001]

<BR>[Industrial Application]

This invention relates to the digital disposal circuit and the motion detector which outputs the motion signal specifically used as motion ead digital disposal circuits, such as a motion ead scanning-line interpolation circuit, and a control signal of those especially about the liquid crystal display which makes a compound colour television signal an input signal.

<BR>[0002]

<BR>[Description of the Prior Art]

In the personal computer, the picture signal supports the monitor only for personal computers for a display called a television set in a television signal.  
Recently, there is a motion of displaying the signal for such image display on the same display.

Displaying that the image which displays that it becomes smooth [ the motion ] more

[ the image with the motion by the television signal ] in order to prevent degradation of image quality in such a motion, and does not have the motion by the graphical data (picture signal) from a personal computer becomes clearer is performed.

<BR>[0003]

In recent years, in the receiving set (receiving set) of the present colour television signal, enlargement and the high performance mold of a display are advancing and degradation of the image quality resulting from the signal aspect of a television signal is increasingly conspicuous in connection with this.

<BR>[0004]

On the other hand, a digital-signal-processing technique and the high quality picture technologies using mass digital memory are proposed variously. For example, it is the signal-processing technique which performs only Rhine interpolation, the scanning line is increased, or performs only field interpolation and increases the scanning line. By carrying out such signal processing, the television signal of sequential scanning was generated and the high definition image has been obtained.

<BR>[0005]

However, the notch occurred in the edge section of the image which is running by the approach of performing only Rhine interpolation and increasing the scanning line by the approach of technical problems, like degradation of vertical definition is conspicuous occurring when a still picture is displayed, and performing only field interpolation, and increasing the scanning line if an animation is displayed, and technical problems, like degradation of image quality is conspicuous occurred. A motion ecad digital disposal circuit is raised as one of the digital disposal circuits for improving such a technical problem.

This motion ecad digital disposal circuit detects a motion of an image in a motion detector, and changes the interpolation approach of a television signal according to that motion.

<BR>[0006]

the circuitry of this motion detector and a motion ecad digital disposal circuit -- &quot; -- it is indicated by &quot;extended definition television handbook&quot; 129th page - 155th page&quot;. [ edited by the extended definition television spreading-and-promotion conference ] [ of chapter 6 ]

<BR>[0007]

Hereafter, the circuitry indicated by this reference is explained using a drawing.

<BR>[0008]

The conventional example of a motion detector is first explained using

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is the block diagram of the conventional motion detector.

In drawing, 90a is a motion detector and has the frame memory 92 which carries out one-frame period delay of the television signal inputted into an input terminal 90, and the subtractor circuit 93 which performs subtraction processing with the television signal and the television signal from an input terminal 90 which carried out one-frame period delay.

A low pass filter (it is hereafter described as LPF.) 94 is connected to the output of this subtractor circuit 93, and the absolute-value circuit 95 which takes the

absolute value of the output of this LPF94 is connected to it between this LPF94 and an output terminal 91.

Here, the television signal inputted into an input terminal 90 is made into the composite colour television signal (it is hereafter described as a color-television signal.) of NTSC system.

<BR>[0009]

In such motion detector 90a of a configuration, the color-television signal inputted from the input terminal 90 is first inputted into a frame memory 92, and the color-television signal which carried out one-frame period delay is acquired from this frame memory 92.

And this color-television signal and color-television signal (present signal) from an input terminal 90 that carried out one-frame period delay are inputted into a subtractor circuit 93, and 1 inter-frame difference signal is outputted from a subtractor circuit 93.

Here, a motion of a display image is detectable because suppose that the above-mentioned present signal is the thing of a still picture part when 1 inter-frame difference signal is 0, and the above-mentioned present signal considers as the thing of an animation part when it is not 0.

<BR>[0010]

However, by the color-television signal, in contiguity inter-frame, since in phase and a chrominance-signal component serve as an opposite phase in the luminance-signal component, the chrominance-signal component other than the component of a motion is contained in the above-mentioned 1 inter-frame difference signal.

Then, a chrominance-signal component is removed by restricting the band of a chrominance-signal component by LPF94 to the above-mentioned 1 inter-frame difference signal.

It is inputted into an absolute-value circuit 95, the polarity of that positive/negative is removed here, and 1 inter-frame difference signal with which this chrominance-signal component was removed is outputted as an output terminal 91 lost-motion signal.

And this motion signal will be used as a control signal of a motion ecad digital disposal circuit.

<BR>[0011]

Next, a motion ecad scanning-line interpolation circuit (it is hereafter written as a motion adaptation interpolation circuit.) is explained as an example of a motion ecad digital disposal circuit.

<BR>[0012]

This motion ecad interpolation circuit is a digital disposal circuit changed into the television signal (it is hereafter described as a non-interlace TV signal.) of sequential scanning of the television signal (it is hereafter described as an interlace TV signal.) of interlaced scanning, in case it creates a interpolation scan signal, it performs signal processing according to a motion of an image, and it outputs the non-interlace TV signal which can display a high definition image without the Rhine flicker etc.

Hereafter, this motion adaptation interpolation circuit is explained using

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<BR>[0013]

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is the block diagram of the conventional motion adaptation interpolation circuit. In drawing, 100a moves, is an adaptation interpolation circuit and has the Rhine memory 103 connected to the input terminal 100 of a television signal, the field memory 104 connected to the output, and the adder circuit 105 connected to the output and the above-mentioned input terminal 100 of this Rhine memory 103. The constant multiplication circuit 106 is connected to the output of this adder circuit 105, and the mixing circuit 107 which mixes these output signals based on the above-mentioned motion signal from an input terminal 101 is connected to the output and the output of the above-mentioned field memory 104. Moreover, based on the interlace TV signal inputted from the above-mentioned input terminal 100, and the output of this mixing circuit 107, the \*\*\*\* conversion circuit 108 which creates a non-interlace TV signal and is outputted to an output terminal 102 is formed in the last stage of this motion ead interpolation circuit 100a. Here, the television signal (it is hereafter described as a TV signal.) of the NTSC system which is the television signal of the 525 number of scanning lines and interlaced scanning as a television signal inputted into an input terminal 100 is explained to an example. In addition, from an input terminal 101, the motion signal created in the motion detector of

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is inputted.

&lt;BR&gt;[0014]

First, if the TV signal inputted from the input terminal 100 is inputted into the Rhine memory 103, this Rhine memory 103 will output the TV signal which carried out 1H (1 horizontal-scanning period of television signal) delay. This TV signal and TV signal from an input terminal 100 that were delayed 1H are added in an adder circuit 105, and double 1/2 in the constant multiplication circuit 106.

The signal which averaged by this the TV signal and the TV signal from an input terminal 100 which were delayed 1H is acquired from the constant multiplication circuit 106.

And this averaged signal is inputted into a mixing circuit 107 as a interpolation signal for animations.

&lt;BR&gt;[0015]

On the other hand, the TV signal which is outputted from the Rhine memory 103 and which was delayed 1H branches, and is inputted into a field memory 104. Processing by which an input signal is delayed in a field memory 104 262H is performed.

Therefore, the signal outputted from a field memory 104 turns into a signal delayed 263H to the TV signal from an input terminal 100.

And this TV signal delayed 263H is inputted into a mixing circuit 107 as a interpolation signal for still pictures.

With extent of a motion of the motion signal from an input terminal 101, a mixing circuit 107 mixes and outputs the interpolation signal for still pictures, and the interpolation signal for animations so that a mixing ratio may change.

&lt;BR&gt;[0016]

Here, when a motion of a motion signal is small, the above-mentioned mixing circuit 107 mainly chooses the interpolation signal for still pictures, outputs it, and when a motion of a motion signal is large, it operates so that the interpolation signal for animations may mainly be chosen and may be outputted.

And after the \*\*\*\* conversion circuit 108 makes a real signal the TV signal from an input terminal 100, undergoes the output from a mixing circuit 107 as a interpolation signal and carries out time amount compression of these signals one half, it changes a real signal and a interpolation signal for every line, creates a non-interlace TV signal, and outputs this to an output terminal 102.

&lt;BR&gt;[0017]

Next, it supplements with explanation using

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about actuation of the above-mentioned motion adaptation interpolation circuit.

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is drawing for moving and explaining the principle of operation of adaptation  
 interpolation, and shows the array of the picture signal corresponding to the  
 predetermined pixel in two or more continuous fields.

In

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TARGET="tjitemdrw">drawing 11</A>

, a longitudinal direction is time amount (field) shaft orientations, and the  
 lengthwise direction is the perpendicular direction of the display screen.

Now, the present TV signal to observe considers as the signal A0 of m field eye.

In this case, the mixing circuit 107 of

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creates the interpolation signal of I0 part of m field eye shown in

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At this time, the TV signal which is acquired from the Rhine memory 103 of

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TARGET="tjitemdrw">drawing 10</A>

and which was delayed 1H turns into a signal A1.

Moreover, since a TV signal is an interlace signal of the 525 scanning lines, the TV  
 signal which is acquired from a field memory 104 and which was delayed 263H turns  
 into the signal A263 of a field (m-1) eye.

The signal with which the signal A263 averaged the interpolation signal for still  
 pictures, the signal A1, and the signal A0 here turns into a interpolation signal  
 for animations.

And the mixing circuit 107 of

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TARGET="tjitemdrw">drawing 10</A>

outputs the interpolation signal I0 which mixed both the interpolation signal  
 according to the motion of present TV signal A0.

Then, \*\*\*\* transform processing is performed in the \*\*\*\* conversion circuit 108, and  
 a non-interlace signal is outputted from an output terminal 102.

<BR>[0018]

Moreover,

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shows the configuration of other conventional motion adaptation interpolation  
 circuits, 60a moves in

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TARGET="tjitemdrw">drawing 6</A>

, and it is an adaptation interpolation circuit.

The field memory 62 connected to the input terminal 60, and the Rhine memory 63  
 connected to the output,

It has the Rhine memory 64 connected to the above-mentioned input terminal 60, and  
 the SW circuit 65 which switches and outputs the output of this both Rhine memory 63  
 and 64 based on the motion signal from an input terminal 61.

And a real signal and a interpolation signal are changed to the last stage of this  
 motion ecad interpolation circuit 60a for every line, a non-interlace TV signal is  
 created in it, and the \*\*\*\* conversion circuit 66 which outputs this to an output  
 terminal 67 is formed in it.

<BR>[0019]

Next, actuation is explained.

<BR>[0020]

First, the TV signal inputted from the input terminal 60 is inputted into the Rhine  
 memory 64.

The Rhine memory 64 outputs the TV signal which carried out 1H (1  
 horizontal-scanning period of television signal) delay.

This TV signal delayed 1H is inputted into the SW circuit 65.

<BR>[0021]

On the other hand, the inputted TV signal branches and is inputted into a field  
 memory 62.

Processing by which an input signal is delayed in a field memory 62 262H is  
 performed.

Therefore, the signal outputted from a field memory 62 turns into a signal delayed  
 262H to the TV signal from an input terminal 60.

<BR>[0022]

And this TV signal delayed 262H is inputted into the Rhine memory 63 as a  
 interpolation signal for still pictures.

With extent of a motion of the motion signal from an input terminal 61, the SW  
 circuit 65 chooses and outputs the interpolation signal for output still pictures of  
 the Rhine memory 63, and the interpolation signal for output animations of the Rhine  
 memory 64.

<BR>[0023]

Here, when a motion of a motion signal is small, the SW circuit 65 mainly chooses  
 the interpolation signal for still pictures, and outputs it, and when a motion  
 signal is large, it operates so that the interpolation signal for animations may  
 mainly be chosen and may be outputted.

And the \*\*\*\* conversion circuit 66 changes a real signal and a interpolation signal  
 for every line, creates a non-interlace TV signal, and outputs it to an output  
 terminal 67.

<BR>[0024]

Next, it moves using

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l.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipd1%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000009"

TARGET="tjitemdrw">drawing 7</A>

and supplements with explanation of an adaptation interpolation circuit.

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TARGET="tjitemdrw">Drawing 7</A>

is drawing for moving and explaining the principle of operation of adaptation interpolation, and shows the array of the picture signal corresponding to the predetermined pixel in two or more continuous fields.

In

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TARGET="tjitemdrw">drawing 7</A>

, a longitudinal direction means time amount (field) and a lengthwise direction means the perpendicular direction of a screen.

<BR>[0025]

Now, suppose that the present TV signal to observe is the signal B0 of n field eye. The SW circuit 65 of

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TARGET="tjitemdrw">drawing 6</A>

in this case creates the interpolation signal of BX part of n field eye shown in

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TARGET="tjitemdrw">drawing 7</A>

At this time, the data of present TV signal B0 are stored in the Rhine memory 64 of

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TARGET="tjitemdrw">drawing 6</A>

Moreover, since a TV signal is an interlace signal of the 525 scanning lines, the TV signal which is acquired from the Rhine memory 63 and which was delayed 263H turns into the signal B263 of a field (n-1) eye.

At this time, the data of a signal B263 are stored in the Rhine memory 63 of

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TARGET="tjitemdrw">drawing 6</A>

A signal B263 turns into a interpolation signal for still pictures, and a signal B0 turns into a interpolation signal for animations here.

And the SW circuit 65 of

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TARGET="tjitemdrw">drawing 6</A>

chooses both the interpolation signal according to a motion of present TV signal B0, and outputs it as a interpolation signal BX.

Then, \*\*\*\* transform processing is carried out in the \*\*\*\* conversion circuit 66, and a non-interlace signal is outputted from an output terminal 67.  
In addition, the interpolation method at the time of an animation here is called a double can method.  
<BR>[0026]

Image quality degradation produced in an interlace TV signal by these actuation at that (it is also hereafter called interpolation between the fields.) which uses the signal in front of 1 field with the large functionality of a signal as a interpolation signal in a still picture part in the perpendicular edge part of an image, i.e., monochrome change part of the perpendicular direction of an image, such as the Rhine flicker and degradation of vertical definition, is improvable.  
On the other hand, in an animation part, if field interpolation is performed, since the functionality of a signal is small, it becomes a twin image, or it will fade and admiration will be produced, a interpolation signal is created using the signal in the same field (it is also hereafter called the interpolation in the field.).  
<BR>[0027]

As mentioned above, by the Prior art, by the motion detector and the motion adaptation interpolation circuit, image quality degradation of the Rhine flicker, degradation of vertical definition, etc. produced with the present television set was prevented, and high definition-ization is realized.  
<BR>[0028]

<BR>[Problem(s) to be solved by the Invention]

However, in the above-mentioned conventional motion adaptation interpolation circuit, interpolation in the field is performed as interpolation processing of an animation part, and interpolation between the fields is performed as interpolation processing of a still picture part.  
For this reason, when a superimposition etc. is processed and it inserts a still picture especially into an animation field, both interpolation processings occur in the boundary line of the animation section and the still picture section, and there is a trouble that a flicker and degradation of an image arise [ an image ].  
About processing of the motion adaptation interpolation circuit in the case of inserting a still picture into an animation field below, using

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l.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3  
D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000010"  
TARGET="tjitemdrw">Drawing 8</A>  
, the time of a doubles can is mentioned as an example, and is explained.  
<BR>[0029]

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l.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3  
D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000010"  
TARGET="tjitemdrw">Drawing 8</A>  
is drawing for explaining the motion detection by the conventional motion detector,  
and the interpolation actuation by the motion adaptation interpolation circuit, and  
shows the array of the picture signal corresponding to the predetermined pixel in  
two or more continuous fields.

In  
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l.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3  
D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000010"  
TARGET="tjitemdrw">drawing 8</A>  
, an axis of abscissa shows the direction of time amount (field), and an axis of  
ordinate shows the perpendicular direction of a screen.  
Moreover, in

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 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000010"  
 TARGET="tjitemdrw">drawing 8</A>  
 , the picture signal of a pixel [ in / in a black dot / an animation field ] and a  
 white round head are the picture signals of the pixel in a still picture field.  
 Now, let the present field to observe be m field eye.  
 <BR>[0030]

First, a motion of the image on a screen is detected by motion detector 90a shown in

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 l.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3  
 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000011"  
 TARGET="tjitemdrw">drawing 9</A>

This motion detector judges a motion of the present signal by subtraction with the present signal and the signal of one frame ago.

That is, a motion of the signal a0 of m field eye in

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 l.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3  
 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000010"  
 TARGET="tjitemdrw">drawing 8</A>

is created from difference, this signal a0, and the signal a2 in front of one of  
 them, i.e., (m-2), the signal of a field eye.  
 Hereafter, each motion is similarly detected from the difference of signals b0 and  
 b2, signals c0 and c2, signals d0 and d2, and signals e0 and e2.  
 And the signals b0 and c0 which do not have a signal level difference inter-frame  
 are judged to be the thing of a still picture part, and the signals a0, d0, and e0  
 which have a signal level difference by inter-frame are judged as a thing of an  
 animation part by the result.

<BR>[0031]

Next, a interpolation signal is created in the motion adaptation interpolation circuit shown in

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 l.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3  
 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000008"  
 TARGET="tjitemdrw">drawing 6</A>

The present signal observed now is set to a0.

In this case, the part to interpolate serves as Xa.

The motion signal over the present signal a0 is a signal with which the present signal a0 was judged to be the signal of an animation part here.

Therefore, it interpolates at the interpolation part Xa, the data a0, i.e., present signal, in front of one line.

The data d0 in front of one line are interpolated similarly at the interpolation part Xd.

<BR>[0032]

The present signal which observes the next is set to b0.

In this case, the part to interpolate serves as Xb.

The motion signal over this present signal b0 is a signal with which this present signal b0 was judged to be the signal of a still picture part here.

Therefore, the signal c1 of a before [ 1 field (i.e., (m-1), a field eye) ] is interpolated at the interpolation part Xb.

The signal d1 of a before [ 1 field (i.e., (m-1), a field eye) ] is interpolated similarly at the interpolation part Xc.

Interpolation which ran by the field of m-1 similarly, and balanced the detection result is performed to the interpolation parts Ya, Yb, Yc, and Yd and each Ye.

By the data of the signal Yb in the field (m-1), and the signal b0 in m field, when the field (m-1) and m field were considered to be one-frame screens here, since one side was an animation and another side was a still picture, a flicker of an image occurred in the boundary line of this part (

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TARGET="tjitemdrw">drawing 8</A>

arrow-head A section), i.e., an animation, and a still picture, and there was a trouble that image quality degradation was recognized notably.

<BR>[0033]

It is the purpose of this invention to obtain the liquid crystal display which can avoid that were made in order to solve the above troubles, and the picture signal with which the interpolation processings by the motion adaptation interpolation circuit differ in the pixel of the boundary section of the animation section and the still picture section is displayed, and a flicker of an image and degradation of an image produce this invention.

<BR>[0034]

<BR>[Means for Solving the Problem]

The liquid crystal display concerning this invention received the compound colour television signal, and is equipped with the digital disposal circuit which performs interpolation processing of the scanning line, and the liquid crystal display monitor which performs image display based on the output of this digital disposal circuit.

The 1st field memory which this digital disposal circuit makes carry out 1 field period delay of this compound colour television signal,

The 2nd field memory which carries out 1 field period delay of the output of this 1st field memory,

The motion detector which takes the difference of the input of this 1st field memory, and the output of the 2nd field memory, moves about the picture signal of each pixel from the difference signal, and carries out sequential detection of the information,

The judgment circuit where the appearance force of this motion detector is received, and the picture signal corresponding to this appearance force moves, respectively, there is, and it judges the thing of the animation part of a display image, or the thing of that still picture part as having no motion, undergo the output of this judgment circuit and the judgment result about the appearance force of this motion detector, the output before one line, and the output after one line is compared.

The picture signal over this appearance force is equipped with the boundary judging circuit judged as whether it is the thing of a pixel located in the boundary section of this animation part and a still picture part, and having those with a boundary, and no boundary respectively.

Furthermore, when the above-mentioned digital disposal circuit underwent the output of this boundary judging circuit, and the output of a judgment circuit, and have none of a case with this boundary, and these boundaries and it is judged with having no motion by this judgment circuit.

The picture signal in front of 1 field period of the picture signal over this appearance force is chosen as a television signal of the interpolation scanning line.

When you have none of these boundaries and it is judged with those with a motion by this judgment circuit, it has the television signal selection circuitry which chooses the picture signal in front of one line of the picture signal over this appearance force as a television signal of this interpolation scanning line.

The above-mentioned purpose is attained by that.

<BR>[0035]

<BR>[Function]

In this invention, since it detects whether the pixel located in the boundary section of the animation section and the still picture section is detected, and a motion has an image in this pixel, or there is nothing and was made to perform interpolation processing of the scanning line corresponding to each pixel in consideration of this both detection result, about the pixel of the boundary section of the animation section and the still picture section, it becomes avoidable about the picture signal by different interpolation processing being displayed. For this reason, by judging with there being no motion near [ the boundary section ] the above, even if a motion is in an image, and making the television signal of the scanning line in front of 1 field period into a interpolation signal when a superimposition etc. is processed and it inserts a still picture especially into an animation field, a flicker of the image by the picture signal with which interpolation processings differ in the pixel of the boundary section of the animation section and the still picture section being displayed, and degradation of an image can be prevented.

<BR>[0036]

<BR>[Example]

Hereafter, the example of this invention is explained.

<BR>[0037]

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is a block diagram for explaining the configuration of the liquid crystal display by one example of this invention, and in drawing, 1a is the liquid crystal display of this example, it received the television signal and is equipped with the television digital disposal circuit 1 which performs interpolation processing of the scanning line, the liquid crystal display monitor 11 which performs image display with liquid crystal, and the drive circuit 10 which drives a liquid crystal display monitor 11 based on the output of the above-mentioned television digital disposal circuit 1.

<BR>[0038]

The above-mentioned television digital disposal circuit 1 has the 1st field memory 2 connected to the input terminal 12, the 2nd field memory 3 connected to the output, the 1st Rhine memory 4 connected to the input terminal 12, and the 2nd Rhine memory 5 connected to the output of the 1st field memory 2.

<BR>[0039]

The above-mentioned television digital disposal circuit 1 takes the television signal from an input terminal 12, and the difference of the output of the 2nd field memory 3.

The motion detector 6 which moves about the picture signal of each pixel from the difference signal, and carries out the sequential output of the information as detecting-signal 6a,

The judgment circuit 7 which judges whether there is any motion of an image based on detecting-signal 6a of this motion detector 6, and a reference value Th, or there is nothing,

The part which has a motion of an image based on judgment signal 7a from this judgment circuit 7,

It responds to the judgment result based on judgment signal 7a of the boundary judging circuit 8 which detects the boundary of a part without a motion of an image, and the judgment circuit 7, and boundary judging signal 8a of the boundary judging circuit 8.

One side of the Rhine memory 4 and 5 is chosen, and it has the switching circuit 9 which outputs the output as a television signal of the interpolation scanning line.

<BR>[0040]

Moreover, a real signal and a interpolation signal are changed to the last stage of the above-mentioned television digital disposal circuit 1 for every line, a

non-interlace TV signal is created in it, and the \*\*\*\* conversion circuit 12 which outputs this to the drive circuit 10 is formed in it.  
<BR>[0041]

The interpolation scanning line is the scanning line reconfigured from the original scanning line according to whether there is any motion of an image or there is nothing here.  
<BR>[0042]

As shown in

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TARGET="tjitemdrw">drawing 3</A>  
, the above-mentioned judgment circuit 7 consists of a circuit 71 which subtracts or adds detecting-signal 6a with a reference value Th, if it is the detecting-signal 6a<gt;= reference value Th as a result of the above-mentioned operation, it will output judgment signal 7a of high level (moving and being), and if it is the detecting-signal 6a<lt; reference value Th, it is constituted so that judgment signal 7a of a low level (with no motion) may be outputted.  
<BR>[0043]

Moreover, as shown in

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TARGET="tjitemdrw">drawing 4</A>  
, the above-mentioned boundary judging circuit 8 serves as the Rhine memory 81 and 82 of series connection from a gate circuit 83, and it is constituted so that judgment signal 7a may be stored in the Rhine memory 81 and 82 and one line and the signals 8Y and 8X which were in two lines may be outputted, respectively. If signals 8X, 8Y, and 8Z are based on signal 8Y, as for signal 8X, the signal in front of one line of signal 8Y and signal 8Z will serve as a signal after one line of signal 8Y here.  
Boundary judging signal 8a shown in  
<A  
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran\_web\_cgi\_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D%3D7%3C%3D%3A%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000007"  
TARGET="tjitemdrw">drawing 5</A>  
as a boundary judging result is obtained by the output of the gate circuit 83 which considers these as an input.  
<BR>[0044]

Next, actuation is explained.  
<BR>[0045]

The television signal of the NTSC system impressed to the input terminal 12 is inputted into the 1st field memory 2, the 1st Rhine memory 4, and the motion detector 6.  
Only 1 H delay a television signal and the Rhine memory 4 outputs it.  
Moreover, after a field memory 2 stores the television signal of the 1 field, only 1 field period (1 / 60 seconds) delays a television signal by outputting.  
The output of this field memory 2 is inputted into the 2nd field memory 3 and the 2nd Rhine memory 5.  
Like the Rhine memory 4 of the above 1st, only 1 H delay a television signal and the 2nd Rhine memory 5 outputs it.  
Therefore, the 2nd Rhine memory 5 will output the television signal in which only 1 field period was from the output of the 1st Rhine memory 4.  
<BR>[0046]

As for the 2nd field memory 3, only 1 field period (1 / 60 seconds) delays a television signal like the 1st field memory 2. Therefore, at the time of day when television signal Sm corresponding to the pixel a0 of m field was inputted into the input terminal 12 as shown in

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 TARGET="tjitemdrw">drawing 2</A>  
 , a field memory 3 outputs television signal Sm-2 corresponding to the pixel a2 of the m-2 field of one frame ago exactly.  
 <BR>[0047]

By adding or subtracting television signal Sm-2 and television signal Sm from an input terminal 12 from a field memory 3, the motion detector 6 outputs detecting-signal 6a showing extent of a motion of an image. In the above-mentioned judgment circuit 7, based on detecting-signal 6a and a reference value Th, the present pixel a0 judges the thing of an animation part, and the thing of a still picture part, and outputs judgment signal 7a. Furthermore, the boundary judging circuit 8 distinguishes whether the boundary line of an animation part and a still picture part is near the present pixel a0 from judgment signal 7a, and outputs boundary judging signal 8a.  
 <BR>[0048]

And a switching circuit 9 chooses the output of either the above-mentioned Rhine memory 4 and the Rhine memory 5 according to judgment signal 7a from the judgment circuit 7, and boundary judging signal 8a of the boundary judging circuit 8, and outputs this to the \*\*\*\* conversion circuit 13 as a television signal of a interpolation scan.  
 <BR>[0049]

For example, creation of a interpolation scan signal when a television signal like  
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 HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran\_web\_cgi\_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D%3D7%3C%3D%3A%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000004"  
 TARGET="tjitemdrw">drawing 2</A>  
 is inputted is considered.  
 <BR>[0050]

If the pixel which should be observed is now made into a pixel a0, the signal over the pixel a2 of the m-2 field which carried out one-frame period delay at the output of a field memory 3 will be outputted, and the motion detector 6 will carry out the comparison operation of a signal about a pixel a0 and a pixel a2. Similarly, the comparison operation of a signal is carried out and detecting-signal 6a which expresses extent of a motion of an image one by one is outputted about a pixel b0, b2 and c0, c2 and d0, and d2, e0 and e2.  
 <BR>[0051]

If the above-mentioned judgment circuit 7 is the detecting-signal 6a> reference value Th by subtracting or adding detecting-signal 6a with a reference value Th, it will output judgment signal 7a of high level (moving and being), and if it is the detecting-signal 6a< reference value Th, it will output judgment signal 7a of a low level (with no motion).  
 <BR>[0052]

And the pixels b0 and c0 which do not have a signal level difference inter-frame are judged to be motion nothing, i.e., a still picture part, things, the pixels a0, d0, and e0 which have a signal level difference by inter-frame move, and there is the result, namely, it is judged to be the thing of an animation part.  
 <BR>[0053]

Next, a interpolation signal is created based on the output of the judgment circuit



7 of

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 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000003"  
 TARGET="tjitemdrw">drawing 1</A>  
 , and the boundary judging circuit 8.  
 If the pixel which should be observed is made into a pixel a0, the part to  
 interpolate will serve as Xa.  
 Although the pixel a0 is judged to be those with a motion from the above-mentioned  
 result here and the pixel a0 in front of one line is originally interpolated at the  
 interpolation part Xa, considering this decision result, boundary judging signal 8a  
 outputted from the boundary judging circuit 8 will have priority over the  
 above-mentioned judgment result, and the signal of the pixel a0 in front of one line  
 is not interpolated.  
 <BR>[0054]

This boundary judging circuit 8 stores judgment signal 7a in the Rhine memory 81 and  
 82, and outputs one line and the signals 8Y and 8X which were in two lines,  
 respectively.

If signals 8x, 8y, and 8z are based on signal 8y, as for signal 8x, the signal in  
 front of one line of signal 8y and signal 8z will serve as a signal after one line  
 of signal 8y here.

Boundary judging signal 8a the result is indicated to be to

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 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000007"  
 TARGET="tjitemdrw">drawing 5</A>

is obtained by the output of the gate circuit 83 which considers these as an input.  
 And in the above-mentioned SW circuit 9, it judges whether it is that all of the  
 motion detecting signal of pixels aa, a0, and b0 are the same motion detecting  
 signals (an animation or still picture) about the pixel a0 of m field signal of

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 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000004"  
 TARGET="tjitemdrw">drawing 2</A>

by the gate circuit 83 from the motion detecting signal corresponding to each of the  
 pixel aa in front of this pixel a 0 or 1 line, and the pixel b0 after one line.  
 <BR>[0055]

The picture signal of a pixel a0 is interpolated at the part Xa which will be  
 interpolated if pixels aa, a0, and b0 correspond to the same motion detecting signal  
 altogether, and if there is a motion detecting signal which is different at least  
 one, the picture signal of a pixel b1 will be interpolated at the above-mentioned  
 interpolation part Xa.

It moves to pixels a0, b0, and c0 similarly, and a detecting signal is compared,  
 since a motion detecting signal differs from at least one into the interpolation  
 part Xb to a pixel b0 as shown in

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 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000007"  
 TARGET="tjitemdrw">drawing 5</A>

, it is judged as those with a boundary, and the picture signal of a pixel c1 is  
 interpolated.

Moreover, it does in this way and the picture signal of a pixel e0 is interpolated  
 at the interpolation part [ as opposed to / in the picture signal of a pixel d1 / a  
 pixel d0 in the interpolation part Xc to a pixel c0 ] Xd into the interpolation part  
 [ as opposed to a pixel e0 in the picture signal of a pixel e1 ] Xe.

<BR>[0056]



This processing is performed for every field and the case of the m-1 field is considered below.  
<BR>[0057]

If the pixel which should be observed is now made into a pixel a1, the pixel a3 of the m-3 field which carried out one-frame period delay of the m-1 field will be outputted, and the motion detector 6 will carry out the comparison operation of the pixels a1 and a3 to the output of a field memory 3. Pixels b1 and b3, pixel c1, c3 and pixel d1, and d3 and pixel e1 are similarly compared with e3, and the sequential output of the detecting-signal 6a showing extent of a motion of an image is carried out.  
<BR>[0058]

In the above-mentioned judgment circuit 7, the judgment of the motion detecting signal to each pixel is performed like the above. And the pixels c1 and d1 which do not have a signal level difference inter-frame are judged to be motion-nothing, i.e., a still picture, the pixels a1, b1, and e1 which have a signal level difference by inter-frame move, and there is the result, namely, it is judged to be an animation.  
<BR>[0059]

Creation of a interpolation signal is performed still like the above. If the pixel which should be observed here is made into a pixel a1, the part to interpolate will serve as Ya. Although the pixel a1 is judged to be those with a motion from the above-mentioned result here and the picture signal of the pixel a1 in front of one line is originally interpolated from this result at the above-mentioned interpolation part Ya, boundary judging signal 8a outputted from the boundary judging circuit 8 will have priority over the judgment result of the judgment circuit 7, and the pixel a1 in front of one line is not interpolated.  
<BR>[0060]

That is, in the SW circuit 9, it judges whether there is any thing corresponding to the motion detecting signal which is [ pixels / ab, a1, and b1 ] different in whether these are all the things corresponding to the same motion detecting signal (an animation or still picture) at least one about the pixel a1 of the m-1 field signal of

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TARGET="tjitemdrw">drawing 2</A>

from the motion detecting signal of the pixel ab in front of this pixel a 1 or 1 line and the pixel b1 after one line.

If there is a thing corresponding to the motion detecting signal which it will be judged with having no boundary than boundary judging signal 8a, and the picture signal of a pixel a1 will be interpolated at the part Ya to interpolate if the above-mentioned pixels ab, a1, and b1 correspond to the same detecting signal altogether, and is different at least one, it will be judged with those with a boundary from boundary judging signal 8a, and the picture signal of a pixel a2 will be interpolated at the above-mentioned interpolation part Ya.

By the array pattern of the pixel signal shown in this

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TARGET="tjitemdrw">drawing 2</A>

, a interpolation signal turns into a picture signal of a pixel a1.

<BR>[0061]

The motion detecting signal of pixels a1, b1, and c1 is compared similarly. Here, since there is at least one thing corresponding to a different motion detecting signal as shown in

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 D%3D7%3C%3D%3A%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000007"  
 TARGET="tjitemdrw">drawing 5</A>  
 , it is judged with those with a boundary and the picture signal of a pixel b2 is  
 interpolated at the interpolation part Yb to a pixel b1.  
 Similarly, into the interpolation part Yd to the pixel [ in / in the picture signal  
 of a pixel c2 / pixels c1, d1, and e1 ] d1, the picture signal of a pixel d2 is  
 interpolated at the interpolation part Yc to the pixel c1 in pixels b1, c1, and d1.  
 <BR>[0062]

Thus, based on the above-mentioned judgment signal 7a and boundary judging signal  
 8a, the above-mentioned switching circuit 9 chooses the output of either the Rhine  
 memory 4 and the Rhine memory 5 so that the predetermined interpolation scanning  
 line may be taken, and it outputs it to the \*\*\*\* conversion circuit 13 as a  
 television signal of a interpolation scan.  
 <BR>[0063]

And by this \*\*\*\* conversion circuit 13, the non-interlaced television signal  
 acquired based on the television signal from the output and input terminal 12 of the  
 above-mentioned switching circuit 9 is inputted into the drive circuit 10.  
 <BR>[0064]

This drive circuit 10 drives a liquid crystal display monitor 11 based on this  
 television signal.  
 <BR>[0065]

Thus, in this example, the pixel located in the boundary section of the animation  
 section of the display screen and the still picture section is detected in the  
 television digital disposal circuit 1.  
 and when it detects and this pixel is located in the boundary section, whether a  
 motion has an image in this pixel, or there is nothing  
 Since the data in front of 1 field of the data (picture signal) of this pixel were  
 interpolated, into the interpolation part to this pixel, a flicker by the picture  
 signal by the interpolation approach which is different in the pixel of the  
 above-mentioned boundary section being displayed is lost, and degradation of image  
 quality can be prevented into it.  
 <BR>[0066]

<BR>[Effect of the Invention]

Since according to this invention it detects whether the pixel located in the  
 boundary section of the animation section and the still picture section is detected,  
 and a motion has an image in this pixel, or there is nothing and was made to perform  
 interpolation actuation corresponding to each pixel in consideration of this both  
 detection result

It is a superimposition etc., and a flicker by the picture signal by the  
 interpolation approach which is different in the pixel of the above-mentioned  
 boundary section being displayed by the case where a still picture is inserted  
 especially into an animation field is lost, and it is effective in the ability to  
 prevent degradation of an image.

<BR><BR>

<BR><BR><HR>DESCRIPTION OF DRAWINGS

<HR>[Brief Description of the Drawings]

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 D%3D7%3C%3D%3A%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000003"  
 TARGET="tjitemdrw">[Drawing 1]</A>

It is the block diagram showing the configuration of the liquid crystal display by

the 1st example of this invention.

<BR><A

HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran\_web\_cgi\_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000004"

TARGET="tjitemdrw">[Drawing 2]</A>

It is drawing for explaining interpolation actuation of the pixel signal in the television digital disposal circuit of the above-mentioned liquid crystal display, and the array of the pixel signal of the perpendicular direction in the predetermined location of the display screen is crossed to a part for the 4 field, and is shown.

<BR><A

HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran\_web\_cgi\_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000005"

TARGET="tjitemdrw">[Drawing 3]</A>

It is drawing showing the concrete configuration of the judgment circuit 7 which constitutes the above-mentioned television digital disposal circuit.

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HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran\_web\_cgi\_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2Ftokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3F7%3D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000006"

TARGET="tjitemdrw">[Drawing 4]</A>

It is drawing showing the concrete configuration of the boundary judging circuit 8 which constitutes the above-mentioned television digital disposal circuit.

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TARGET="tjitemdrw">[Drawing 5]</A>

It is drawing showing the judgment result based on boundary judging signal 8a of the above-mentioned boundary judging circuit 8.

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TARGET="tjitemdrw">[Drawing 6]</A>

It is the block diagram showing the configuration of the motion adaptation interpolation circuit which performs interpolation actuation with the conventional doubles can method.

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TARGET="tjitemdrw">[Drawing 7]</A>

It is drawing for explaining the principle of operation of the motion adaptation interpolation by the conventional doubles can method.

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TARGET="tjitemdrw">[Drawing 8]</A>

It is drawing for explaining the interpolation actuation in the motion adaptation interpolation circuit of the conventional doubles can method, and the array of the pixel signal of the perpendicular direction in the predetermined location of the display screen is crossed to a part for the 4 field, and is shown.

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 HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran\_web\_cgi\_ejje?u=http%3A%2F%2Fwww4.ipd  
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 TARGET="tjitemdrw">[Drawing 9]</A>

It is the block diagram showing the configuration of the conventional motion  
 detector.

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 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000012"  
 TARGET="tjitemdrw">[Drawing 10]</A>

It is the block diagram showing the configuration of the conventional motion  
 adaptation interpolation circuit.

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 D%3D7%3C%3D%3A%2F%2F%2F%26N0001%3D619%26N0552%3D9%26N0553%3D000013"  
 TARGET="tjitemdrw">[Drawing 11]</A>

It is drawing for explaining the principle of operation of the conventional motion  
 adaptation interpolation circuit.

<BR>[Description of Notations]

<BR>1 Television Digital Disposal Circuit  
 <BR>1a Liquid crystal display  
 <BR>2 Three Field memory  
 <BR>4 Five Rhine memory  
 <BR>6 Motion Detector  
 <BR>7 Judgment Circuit  
 <BR>8 Boundary Judging Circuit  
 <BR>9 Switching Circuit  
 <BR>10 Drive Circuit  
 <BR>11 Liquid Crystal Display Monitor  
 <BR>13 \*\*\*\* Conversion Circuit  
 <BR><BR>  
 <HR></BODY></HTML>